

breaks, likelihood of the presence of a commercial at any given time in a set of audiovisual content). Optimization can be done over the total set of commercial location decisions, rather than on a per-commercial basis. Additionally, the cost function can be iteratively evaluated, increasing the accuracy of commercial location decisions produced by the method. Additionally, many more types of cues and combinations of cues can be used in detection of commercials in accordance with the invention than have been used in other approaches to commercial detection.

REMARKS

The specification and abstract have been amended to correct grammatical and idiomatic errors. Applicant requests entry of the amendments to the specification and abstract.

Claims 12-68 have been added to more fully claim the invention. Support for Claims 12-15 is found in Applicant's specification at, for example, page 14, line 28 to page 16, line 21. Support for Claims 16-20 is found in Applicant's specification at, for example, page 16, line 22 to page 18, line 30. Support for Claims 21-25 is found in Applicant's specification at, for example, page 18, line 31 to page 19, line 23. Support for Claim 26 is found in Applicant's specification at, for example, page 18, lines 20-25. Support for Claim 27 is found in Applicant's specification at, for example, page 21, lines 23-24. Support for Claims 28-32 is found in

Applicant's specification at, for example, page 21, line 25 to page 22, line 8. Support for Claim 33 is found in Applicant's specification at, for example, page 22, line 9 to page 23, line 19. Support for Claim 34 is found in Applicant's specification at, for example, page 23, line 20 to page 25, line 18. Support for Claims 35-39 is found in Applicant's specification at, for example, page 5, lines 4-12 and page 8, line 30 to page 9, line 6. Support for Claims 40-43 is found in Applicant's specification at, for example, page 26, lines 27-33. Support for Claim 44 is found in Applicant's specification at, for example, page 26, line 33 to page 27, line 2 and page 25, line 19 to page 26, line 20. Support for Claims 45-46 is found in Applicant's specification at, for example, page 4, lines 12-14 and page 6, line 16 to page 8, line 8, as well as generally throughout Applicant's specification. Support for Claims 47-49 is found in Applicant's specification at, for example, page 4, lines 14-20, as well as generally throughout Applicant's specification. Support for Claims 50-51 is found in Applicant's specification at, for example, page 4, lines 22-31, as well as generally throughout Applicant's specification. Support for Claims 52-68 is found in Applicant's specification at, for example, page 14, lines 9-27.

Claims 1-11 were pending. Claims 1 and 8-11 have been amended. Claims 12-68 have been added. Allowance of Claims 1-68

is requested. If the Examiner wishes to discuss any aspect of this application, the Examiner is invited to telephone Applicant's undersigned attorney at (408) 945-9912.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on November 30, 2001.

11-30-01 David R. Graham
Date Signature

Respectfully submitted,

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Version with Markings to Show Changes Made

(Additions are underlined, deletions are enclosed in brackets)

In the specification:

The paragraph beginning at page 7, line 4 has been amended as follows:

In step 103 of the method 100, the scores associated with each candidate time are adjusted. The score for a candidate time can be adjusted, for example, based on an analysis of one or more cues proximate to the candidate time that are different [than] from the one or more cues used to identify the candidate time. For instance, as described in more detail below with respect to step 206 of the method 200 (see Figure 2) the score associated with a candidate time can be adjusted based on the presence or absence of one or more cues within a specified time window that includes the candidate time or to which the candidate time is sufficiently proximate (i.e., is less than a specified short amount of time, such as several seconds, before or after the time window). The score for a candidate time can also be adjusted, for example, based on an evaluation of the relationship between the candidate time and one or more other candidate times. In particular, as described in more detail below with respect to step 207 of the method 200 (see Figure 2), this latter type of adjustment can make use of one or more probability models that describe expected relationship(s) between a candidate time and the one or more other candidate times.

The paragraph beginning at page 11, line 16 has been amended as follows:

In step 205 of the method 200, one or more of the cues identified in step 204 are analyzed to identify candidate times within the audiovisual content at which a commercial beginning or a commercial ending may occur. For example, an audio pause often accompanies either the beginning or the end of a commercial, so the presence of an audio pause in the audio content can be identified as a factor that militates toward establishing a candidate time at some time during or proximate to the audio pause. Similarly, a sequence of black frames often accompanies either the beginning or the end of a commercial, so the presence of a sequence of black frames in the visual content can be identified as a factor that militates toward establishing a candidate time at some time during or proximate to the sequence of black frames. A scene cut or fade also typically accompanies the beginning or the end of a commercial, so the presence of a scene break or fade in the visual content can be identified as a factor that militates toward establishing a candidate time at some time during or proximate to the scene break or fade. The beginning and end of a commercial break are often accompanied by a noticeable increase and decrease in volume, respectively, so that a significant change in average volume (measured over a specified window of time) can be identified as a factor that militates toward establishing a candidate time at some time proximate to times at which the volume is seen to change significantly. Commercials often include relatively more musical

content than the rest of a set of audiovisual content, so the occurrence of a time window of specified duration (e.g., the expected duration of a typical commercial break, such as 60 seconds, or the expected duration of a typical commercial, such as 15 or 30 seconds) having relatively high musical content (e.g., relatively high density of musical content relative to the density of musical content in other, proximate time windows) can be identified as a factor that militates toward establishing candidate times at the beginning and end of such a time window. The beginning or end of a commercial is often accompanied by a change in speaker identity, so the occurrence of a change in speaker identity can be identified as a factor that militates toward establishing a candidate time at, or proximate to, the time at which such a change in speaker identity occurs. A commercial break often includes a relatively high density of scene breaks and/or fades (since a scene break or fade typically occurs at the beginning and end of a commercial break, as well as at the transition between commercials within a commercial break, and since commercials often include a relatively large number of scene breaks and/or fades per unit time within the commercial), so the occurrence of a time window of a specified duration (e.g., 60 seconds) during which the density of scene breaks and/or scene fades is relatively high (i.e., exceeds a specified threshold), or a significant change in density of scene breaks and/or scene fades over one window of time with respect to a proximate window of time, can be identified as a factor that militates toward establishing candidate times at the beginning

and end of such a time window. A network icon is sometimes present during the noncommercial parts of a television broadcast; therefore, if a network icon is determined to be present in a set of audiovisual content, the disappearance of the network icon typically accompanies the beginning of a commercial break and the appearance of the network icon typically accompanies the end of a commercial break, so the appearance or disappearance of a network icon can be identified as a factor that militates toward establishing a candidate time at, or proximate to, a time at which the network icon appears or disappears. Since the average motion level in the visual content of a commercial is often significantly different [than] from the average motion level of other visual content in a set of audiovisual content, significant change in the amount of motion in the visual content of a time window (e.g., about 60 seconds) relative to the amount of motion in the visual content in a proximate time window can be identified as a factor that militates toward establishing candidate times at, or proximate to, the beginning and end of such a time window. The appearance of text (other than closed-captioning) in a set of audiovisual content often accompanies the beginning of a commercial break and the disappearance of text often accompanies the end of a commercial break, so the appearance or disappearance in a set of audiovisual content of text other than closed-captioning can be identified as a factor that militates toward establishing a candidate time at, or proximate to, a time at which text appears or disappears. If closed-captioning data is present in the data representing the

audiovisual content, a closed-captioning scrolling format change often occurs at the beginning or the end of a commercial break, so the occurrence of a closed-captioning scrolling format change can be identified as a factor that militates toward establishing a candidate time at, or proximate to, the time at which such a format change occurs. If closed-captioning data is present in the data representing the audiovisual content, the disappearance of closed-captioning often accompanies the beginning of a commercial break and the appearance of closed-captioning often accompanies the end of a commercial break, so the appearance or disappearance of closed-captioning can be identified as a factor that militates toward establishing a candidate time at, or proximate to, a time at which closed-captioning appears or disappears.

The paragraph beginning at page 14, line 9 has been amended as follows:

As indicated above, it is an advantageous aspect of the invention that the invention enables use of a combination of the cues to effect commercial detection. In particular, the invention can enable the use of cues and combinations of cues that have not previously been used for commercial detection. For example, the invention can advantageously enable any one of detection of the absence of a network icon, an analysis of musical content present in a set of audiovisual content, the density of scene breaks and/or fades, or analysis of the identity of speakers of spoken content to be used alone as a commercial

detection cue. These cues can also be used in any combination with each other or any other cue. In particular, it is anticipated that one or more of these cues can advantageously be used in combination with one or more of the following cues: 1) the occurrence of an audio pause, 2) the occurrence of a sequence of black frames, 3) a scene cut or fade, 4) the occurrence of specified closed-captioning formatting signals, and 5) the appearance or disappearance of closed-captioning.

The paragraph beginning at page 14, line 28 has been amended as follows:

Step 205 outputs a list of candidate times at which commercials may be beginning or ending, together with a score or probability associated with each candidate time. In one implementation of the invention, each candidate time is assigned the same initial score. Alternatively, the scores assigned to candidate times can vary. For example, the score for a candidate time can depend on which cue(s) were used to identify the candidate time. The beginning or end of a commercial can be deduced from the presence of some cues with a greater degree of confidence than that associated with the presence of other cues. To the extent that a candidate time is identified based on a cue with which a relatively high degree of predictive confidence is associated, the score assigned to that candidate time can be relatively higher than would be the case if a relatively low degree of predictive confidence was associated with the cue. Additionally, the score for each candidate time can be dependent

on how strongly the cue is present in the audiovisual content, as determined in accordance with a criterion or criteria appropriate for that cue: the more strongly a cue is present, the higher the score. For example, when one of the cues used to establish a candidate time is an audio pause, the score established for the candidate time can be dependent on the duration of the audio pause and/or the degree of silence during the audio pause (e.g., the score for the candidate time is made relatively greater the longer the audio pause or the less sound that is present during the audio pause). Or, for example, when one of the cues used to establish a candidate time is a sequence of black frames, the score established for the candidate time can be dependent on the duration of the sequence of black frames and/or the completeness of the blackness of the frames (e.g., the score for the candidate time is made relatively greater the longer or blacker the sequence of black frames). Or, for example, when one of the cues used to establish a candidate time is a scene cut, the score established for the candidate time can be dependent on the number of pixels that changed by more than a threshold amount from one frame to another (e.g., the score for the candidate time is made relatively greater as more pixels changed between scenes) and/or dependent on the total change of all the pixels from one frame to another (where the "change" for each pixel is the change in the color or other components of a pixel). Or, for example, when one of the cues used to establish a candidate time is a significant average audio volume change, the score established for the candidate time can be dependent on degree of the volume change.

(e.g., the score for the candidate time is made relatively greater as degree of the volume change increases). Those skilled in the art can readily appreciate how the score for a candidate time can be adjusted based on aspects of other cues present in the audiovisual content proximate to the candidate time. Additionally, the score for a candidate time can be dependent on the confidence level associated with identification of the cue in the audiovisual content: the greater the confidence level, the higher the score. (This confidence level is different [than] from the confidence level associated with the predictive capability of the cue, discussed above.) For example, sound represented in audio data may be sound in the audio content or noise. The score for a candidate time identified at least in part based on the presence of an audio pause can be increased or decreased in accordance with extent to which the degree of noise present in the audio data increases or decreases the confidence with which an audio pause can be detected.

The paragraph beginning at page 16, line 22 has been amended as follows:

In step 206 of the method 200, the scores associated with each candidate time can be adjusted based on the presence or absence of one or more cues within some time window proximate to the candidate time. The cue(s) used to adjust the score of a candidate time in step 206 are different [than] from the cue(s) used to establish the candidate time and an initial associated score in step 205. The duration of the time window and location

of the time window with respect to the [cue] candidate time is dependent on the type of cue. For instance, the score for a candidate time is increased (i.e., the likelihood that the candidate time correctly indicates the beginning or ending of a commercial is deemed to increase) in each of the following cases: 1) the candidate time is coincident with the time at which an audio pause (which is a window of audio silence or near silence) occurs, 2) the candidate time is within or sufficiently proximate to a time window in which the closed-captioning scrolling format is different from that which is typical for audiovisual content of this type, 3) the candidate time is within or sufficiently proximate to a time window during which closed-captioning is absent (for audiovisual content that is known to be closed-captioned), 4) the candidate time is within or sufficiently proximate to a time window of at least a specified duration (e.g., 60 seconds) and including high musical content, 5) the candidate time is within or sufficiently proximate to a time window during which the density of scene breaks and/or scene fades exceeds a specified threshold, 6) the candidate time is sufficiently proximate to a time window of at least a specified duration (e.g., 0.5 seconds) and in which the average motion in the visual content, measured in a specified manner, is less than a specified threshold, 7) the candidate time is within a time window during which a network icon (which has been found to be persistent through a majority of the visual content) is not present at a specified location within the visual content (e.g., a region, such as a corner, near the edge of the

visual content), 8) the candidate time is very near (e.g., within about 2 seconds) a time at which the time-averaged audio volume (averaged over a time window of about 10 seconds) has changed by a magnitude of greater than a specified threshold, 9) the candidate time is sufficiently proximate to (within about 1 second) a time when text is present in the visual content, 10) the candidate time is within a specified duration of time (e.g., a few seconds) after the presence in the closed-captioning stream of certain keywords or phrases such as "commercial", "break", "coming up" or "after", or within a specified duration of time (e.g., a few seconds) prior to the presence in the closed-captioning stream of certain keywords or phrases such as "welcome", "hello" or "we're back, 11) the candidate time is within a specified duration of time (e.g., 2 seconds) from a time at which the speaker identity has changed, and 12) the candidate time is within a specified duration of time (e.g., one to several seconds) from a time window of greater than a specified duration (e.g., 1 minute) that does not include speech from a speaker whose speech has been determined to be present in the audiovisual content with greater than a specified frequency. The amount by which a score is adjusted can be dependent on the same types of analyses done to establish an initial score for a candidate time, as described above with respect to step 205. (However, the particular analyses done in step 206 need not, but can be[,] the same as those done in step 205.) In particular, the amount of the adjustment to a score for a candidate time can be dependent on how strongly the

cue is present in the audiovisual content, as determined in accordance with a criterion or criteria appropriate for that cue: in general, the more strongly a cue is present, the greater the adjustment to the score. Additionally, the amount of the adjustment to a score for a candidate time can be dependent on how high or low the score is prior to the adjustment. For example, a cue that strongly indicates the presence of a commercial beginning or ending may cause a larger adjustment in a relatively low score than in a relatively high score. The particular quantities, keywords, and other algorithm parameters given above are illustrative; they may be changed, within appropriate constraints, as can be appreciated by those skilled in the art, without adversely affecting the operation of the invention.

The paragraph beginning at page 22, line 9 has been amended as follows:

Step 208 begins by selecting the candidate time with the highest score to be a commercial start or end time (whether that time is a start time or end time is unknown at this point). A commercial break is then constructed based on the selected candidate time by successively evaluating candidate times in order of decreasing score and adding candidate times to the commercial break that satisfy each of the following criteria: 1) the additional candidate time is well-spaced in time, in accordance with the function $S(t)$, from each candidate time that has already been included in the commercial

break, 2) the additional candidate time does not create a commercial break which is too long, in accordance with the function $L(t)$, and 3) the additional candidate time is not too close to other existing commercial breaks, in accordance with the function $W(t)$, that have already been identified by the step 208. Stated another way, candidate times continue to be added to a commercial break in order of score as long as there are any candidate times for which all of the following are true: 1) the value of $S(t)$, where " t " is the time separation between the candidate time being evaluated and a candidate time already included in the commercial break, is above a specified threshold value for each candidate time already included in the commercial break, 2) the value of $L(t)$, where " t " is the duration of the commercial break if the candidate time is added to the commercial break, is [not below] above a specified threshold value, and 3) the value of $W(t)$, where " t " is the time separation between the candidate time and an existing commercial break, is [not below] above a specified threshold value for each existing commercial break.

The paragraph beginning at page 26, line 25 has been amended as follows:

The invention can be used for a wide variety of applications, as can be appreciated by those skilled in the art in view of the description herein. In general, the invention can be used with any broadcast or other data transmission over a network (e.g., conventional network television broadcasts, cable

television broadcasts, broadcasts or transmissions over a computer network such as the Internet - and, in particular, the World Wide Web portion of the Internet). Additionally, the invention can be used generally to detect commercials in audiovisual content represented by any type of data, which data can be stored on a data storage medium or media, or provided to a system or method according to the invention in real time. Further, the invention can be implemented in a wide variety of apparatus, as can also be appreciated by those skilled in the art in view of the description herein, such as, for example, television set-top boxes, digital VCRs, computers (including desktop, portable or handheld computers) or any of a variety of other computational devices (including many which are now being, or will in the future be, developed).

In the claims:

Claims 1 and 8-11 have been amended as follows:

1. (Amended) A method for detecting one or more commercial breaks in a set of audiovisual content spanning a duration of time, each commercial break including one or more commercials, the method comprising the steps of:

identifying candidate times within the duration of time spanned by the set of audiovisual content based on an evaluation of one or more cues identified in the audiovisual content, each candidate time representing a possible starting [time or a possible] and/or ending time of a commercial;

assigning a score to each candidate time;
evaluating, for each of one or more candidate times, 1) one or more secondary cues [other than] that are each different from the one or more cues used to identify the candidate time, and/or 2) the relationship between the candidate time and one or more other candidate times, wherein the score assigned to the candidate time can be adjusted based on the evaluation; and

constructing the one or more commercial breaks based on an evaluation of 1) the scores of the candidate times after the step of evaluating and 2) [the] a relationship between, or relationships among, the candidate times.

8. (Amended) A system for detecting one or more commercial breaks in a set of audiovisual content spanning a duration of time, each commercial break including one or more commercials, the system comprising:

[means for identifying the presence of one or more cues in the audiovisual content;]

means for identifying candidate times within the duration of time spanned by the set of audiovisual content based on an evaluation of one or more cues identified in the audiovisual content, each candidate time representing a possible starting [time or a possible] and/or ending time of a commercial;

means for assigning a score to each candidate time;

means for evaluating, for each of one or more candidate times, 1) one or more secondary cues [other than] that are each different from the one or more cues used to identify the candidate time, and/or 2) the relationship between the candidate time and one or more other candidate times, wherein the score assigned to the candidate time can be adjusted based on the evaluation; and

means for constructing the one or more commercial breaks based on an evaluation of 1) the scores of the candidate times after the step of evaluating and 2) [the] a relationship between, or relationships among, the candidate times.

9. (Amended) A computer readable storage medium or media encoded with one or more computer programs including instructions for detecting one or more commercial breaks in a set of audiovisual content spanning a duration of time, each commercial break including one or more commercials, the one or more computer programs comprising:

[instructions for identifying the presence of one or more cues in the audiovisual content;]

instructions for identifying candidate times within the duration of time spanned by the set of audiovisual content based on an evaluation of one or more cues identified in the audiovisual content, each candidate time representing a possible starting [time or a possible] and/or ending time of a commercial;

instructions for assigning a score to each candidate time;

instructions for evaluating, for each of one or more candidate times, 1) one or more secondary cues [other than] that are each different from the one or more cues used to identify the candidate time, and/or 2) the relationship between the candidate time and one or more other candidate times, wherein the score assigned to the candidate time can be adjusted based on the evaluation; and

instructions for constructing the one or more commercial breaks based on an evaluation of 1) the scores of the candidate times after the step of evaluating and 2) [the] a relationship between, or relationships among, the candidate times.

10. (Amended) A method for detecting one or more commercial breaks in a set of audiovisual content spanning a duration of time, each commercial break including one or more commercials, the method comprising the steps of:

identifying candidate times within the duration of time spanned by the set of audiovisual content based on an evaluation of one or more cues identified in the audiovisual content, each candidate time representing a possible starting [time or a possible] and/or ending time of a commercial;

assigning a score to each candidate time; and

constructing the one or more commercial breaks based on an evaluation of 1) the scores of the candidate times after the step of evaluating and 2) [the] a relationship between, or relationships among, the candidate times.

11. (Amended) A method for detecting one or more commercial breaks in a set of audiovisual content spanning a duration of time, each commercial break including one or more commercials, wherein candidate times, each candidate time representing a possible starting [time or a possible] and/or ending time of a commercial within the duration of time spanned by the set of audiovisual content, have been identified based on an evaluation of one or more cues identified in the audiovisual content and a score assigned to each candidate time, the method comprising the steps of:

evaluating, for each of one or more candidate times, 1) one or more secondary cues [other than] that are each different from the one or more cues used to identify the candidate time, and/or 2) the relationship between the candidate time and one or more other candidate times, wherein the score assigned to the candidate time can be adjusted based on the evaluation; and

constructing the one or more commercial breaks based on an evaluation of 1) the scores of the candidate times after the step of evaluating and 2) [the] a relationship between, or relationships among, the candidate times.

Claims 12-68 have been added as follows:

12. (New) A method as in Claim 1, wherein the step of assigning further comprises the step of assigning the same score to each candidate time.

13. (New) A method as in Claim 1, wherein the step of assigning further comprises the step of assigning a score to each candidate time in accordance with the type of cue or cues evaluated to identify the candidate time.

14. (New) A method as in Claim 1, wherein the step of assigning further comprises the step of assigning a score to each candidate time in accordance with the degree of presence in the audiovisual content of the cue or cues evaluated to identify the candidate time.

15. (New) A method as in Claim 1, wherein the step of assigning further comprises the step of assigning a score to each candidate time in accordance with the degree of confidence of identification of the cue or cues evaluated to identify the candidate time.

16. (New) A method as in Claim 1, wherein the step of evaluating further comprises the step of determining the presence or absence of a secondary cue within a time window that includes the candidate time or to which the candidate time is sufficiently proximate.

17. (New) A method as in Claim 16, wherein the duration and/or location of the time window depends on the type of the secondary cue.

18. (New) A method as in Claim 16, wherein the score is adjusted in accordance with the type of the secondary cue.

19. (New) A method as in Claim 16, wherein the score is adjusted in accordance with the degree of presence of the secondary cue.

20. (New) A method as in Claim 16, wherein the score is adjusted in accordance with the degree of confidence of identification of the secondary cue.

21. (New) A method as in Claim 1, wherein the step of evaluating further comprises the step of comparing the candidate time and/or a relationship between, or relationships among, the candidate time and one or more other candidate times to one or more probability models that specify one or more expected characteristics of commercial start and/or end times, and/or an expected relationship between, or relationships among, commercial start and/or end times.

22. (New) A method as in Claim 21, wherein one of the probability models specifies the expected temporal separation of commercial start and end times.

23. (New) A method as in Claim 21, wherein one of the probability models specifies the expected location of one or more commercial start and/or end times within the duration of time spanned by the set of audiovisual content.

24. (New) A method as in Claim 21, wherein one of the probability models is derived from statistics concerning any type of audiovisual content.

25. (New) A method as in Claim 21, wherein one of the probability models is derived from statistics concerning only audiovisual content that is of the same type as the set of audiovisual content in which the one or more commercials breaks are being detected.

26. (New) A method as in Claim 1, wherein the score adjustment varies in accordance with the magnitude of the score before adjustment.

27. (New) A method as in Claim 1, further comprising the step of eliminating candidate times having an adjusted score below a specified threshold.

28. (New) A method as in Claim 1, wherein the step of constructing further comprises the step of comparing a relationship between, or relationships among, the candidate times to one or more probability models that specify an expected relationship between, or relationships among, commercial start and/or end times.

29. (New) A method as in Claim 28, wherein one of the probability models specifies the expected duration of a commercial break.

30. (New) A method as in Claim 28, wherein one of the probability models specifies the expected temporal separation of commercial breaks.

31. (New) A method as in Claim 28, wherein one of the probability models is derived from statistics concerning any type of audiovisual content.

32. (New) A method as in Claim 28, wherein one of the probability models is derived from statistics concerning only audiovisual content that is of the same type as the set of audiovisual content in which the one or more commercials breaks are being detected.

33. (New) A method as in Claim 28, wherein the step of constructing further comprises the steps of:

selecting the candidate time with the highest adjusted score to be a commercial start and/or end time in a current commercial break;

successively evaluating each candidate time not yet part of a commercial break, in order of decreasing adjusted score, for possible inclusion in the current commercial break as a commercial start and/or end time, wherein the evaluation of each candidate time for possible inclusion in the current commercial break comprises the steps of:

determining whether each probability of the temporal separation between the candidate time being evaluated and a candidate time already included in the current commercial break is above a specified threshold value;

determining whether the probability of the duration of the current commercial break, if the candidate time being evaluated is added to the current commercial break, is above a specified threshold value; and

determining whether each probability of the temporal separation between the candidate time being evaluated and an already existing commercial break, if any, is above a specified threshold value, wherein if each of the three probabilities is above the corresponding specified threshold value, the candidate

time being evaluated is added to the current commercial break;

determining whether there are candidate times having an adjusted score above a specified threshold value that have not yet been included in a commercial break and have not yet been excluded from inclusion in a commercial break;

if there are candidate times having an adjusted score above the specified threshold value that have not yet been included in a commercial break and have not yet been excluded from inclusion in a commercial break, performing the steps of:

selecting the candidate time having the highest adjusted score above the specified threshold value that has not yet been included in a commercial break and has not yet been excluded from inclusion in a commercial break;

determining whether each probability of the temporal separation between the selected candidate time and an already existing commercial break is above a specified threshold value;

if each probability is above the specified threshold value, performing the steps of:

identifying the selected candidate time as a commercial start and/or end time in a current commercial break; and

repeating the step of successively evaluating; and

if each probability is not above the specified threshold value, performing the steps of:

excluding the selected candidate time from inclusion in a commercial break; and

repeating the step of determining whether there are candidate times having an adjusted score above a specified threshold value that have not yet been included in a commercial break and have not yet been excluded from inclusion in a commercial break; and

if there are no candidate times having an adjusted score above the specified threshold value that have not yet been included in a commercial break and have not yet been excluded from inclusion in a commercial break, performing the step of identifying the start and end time of each commercial break and the start time of each commercial in each commercial break.

34. (New) A method as in Claim 33, wherein the step of constructing further comprises the steps of:

determining whether there are any candidate times having an adjusted score above a specified threshold value that have not yet been included in a commercial break;

if there are candidate times having an adjusted score above the specified threshold value that have not yet been included in a commercial break, performing the steps of:

for each such candidate time that has not yet been included in a commercial break, performing the steps of:

identifying the most temporally proximate commercial break to the candidate time;

determining whether the probability of the duration of the most temporally proximate commercial break, if the candidate time is added to that commercial break, is above a specified threshold value; and

determining whether each probability of the temporal separation between the candidate time and a commercial break other than the most temporally proximate commercial break, if any, is above a specified threshold value, wherein if each of the two probabilities are above the corresponding specified threshold value, the candidate time is added to the most temporally proximate commercial break;

if the candidate time is added to the most temporally proximate commercial break, performing the steps of:

repeating the step of successively evaluating, for each candidate time having an adjusted score above a specified threshold value that has not yet been included in a commercial break, wherein the resulting

commercial break is a modified commercial break;

for each candidate time of the modified commercial break, performing the steps of:

computing the average of the probabilities of each temporal separation between the candidate time and a temporally adjacent candidate time;

if the average is below a specified threshold value, performing the steps of:

if the adjusted score of the candidate time is lower than the average adjusted score of the adjacent candidate times, eliminating the candidate time; and

if the adjusted score of the candidate time is not lower than the average adjusted score of the adjacent candidate times, eliminating any adjacent candidate time that is less than a specified duration of time from the candidate time;

computing the average score of all of the candidate times of the modified commercial break;

comparing the average score of all of the candidate times of the modified commercial break to the average score of all of the candidate times of the commercial break before modification;

if the average score of all of the candidate times of the modified commercial break is greater than the average score of all of the candidate times of the original commercial break before modification, replacing the original commercial break with the modified commercial break; and

if the average score of all of the candidate times of the modified commercial break is not greater than the average score of all of the candidate times of the original commercial break before modification, retaining the original commercial break; and

if the candidate time is not added to the most temporally proximate commercial break, performing the step of excluding the candidate time from inclusion in a commercial break; and determining whether a modified commercial break replaced an original commercial break;

if a modified commercial break replaced an original commercial break, repeating the step of determining whether there are any candidate times having an adjusted score above a specified threshold value that have not yet been included in a commercial break and the conditional step appropriate for the result of that determination; and

if no modified commercial break replaced an original commercial break, performing the step of maintaining the identification of the start and end time of each commercial break and the start time of each commercial in each commercial break as existent prior to the step of determining whether there are candidate times having an adjusted score above a specified threshold value that have not yet been included in a commercial break; and

if there are no candidate times having an adjusted score above the specified threshold value that have not yet been included in a commercial break, performing the step of maintaining the identification of the start and end time of each commercial break and the start time of each commercial in each commercial break as existent prior to the step of determining whether there are candidate times having an adjusted score above a specified threshold value that have not yet been included in a commercial break.

35. (New) A method as in Claim 1, further comprising the step of editing the audiovisual content based on the detected commercial breaks.

36. (New) A method as in Claim 35, wherein the step of editing the audiovisual content based on the detected commercial breaks further comprises the step of deleting the audiovisual content representing a commercial.

37. (New) A method as in Claim 35, wherein the step of editing the audiovisual content based on the detected commercial breaks further comprises the step of modifying the audiovisual content representing a commercial.

38. (New) A method for viewing audiovisual content in which commercial breaks have been detected as in Claim 1, comprising the step of skipping a commercial during viewing of the audiovisual content.

39. (New) A method for reviewing audiovisual content in which commercial breaks have been detected as in Claim 1, comprising the step of searching for a commercial within the audiovisual content.

40. (New) A method as in Claim 1, wherein the audiovisual content is represented by a television signal.

41. (New) A method as in Claim 1, wherein the audiovisual content is represented by computer-readable data.

42. (New) A method as in Claim 41, wherein audiovisual content is represented by computer-readable data acquired via a computer network.

43. (New) A method as in Claim 42, wherein audiovisual content is represented by computer-readable data acquired via the Internet.

44. (New) A method as in Claim 1, wherein the method detects the one or more commercial breaks in real time as the audiovisual content is acquired for display by a display device.

45. (New) A method for detecting one or more commercial breaks in a set of audiovisual content spanning a duration of time, each commercial break including one or more commercials, the method comprising the steps of:

selecting a plurality of times within the duration of time spanned by the set of audiovisual content as a current set of commercial starting and/or ending times;

selecting a revised set of commercial starting and/or ending times including the current set of commercial starting and/or ending times and one or more additional times within the duration of time spanned by the set of audiovisual content; and

comparing the revised set of commercial starting and/or ending times to the current set of commercial starting and/or ending times to determine whether the revised set of commercial starting and/or ending times constitute a better set of commercial starting and/or ending times than the current set of commercial starting and/or ending times, wherein:

if not, the method further comprises the step of identifying the current set of commercial starting and/or ending times as a final set of commercial starting and/or ending times; and

if so, the method further comprises the steps of:

identifying the revised set of commercial starting and/or ending times as the current set of commercial starting and/or ending times;

performing the step of selecting a revised set of commercial starting and/or ending times; and

performing the step of comparing the revised set of commercial starting and/or ending times to the current set of commercial starting and/or ending times.

46. (New) A method as in Claim 45, wherein the step of selecting a current set of commercial starting and/or ending times further comprises the steps of:

identifying candidate times within the duration of time spanned by the set of audiovisual content, each candidate time representing a possible starting and/or ending time of a commercial; and

selecting candidate times as one of the current set of commercial starting and ending times based on an evaluation of each candidate time to determine a likelihood that the candidate time is a commercial starting time or ending time.

47. (New) A method for detecting a commercial in a set of audiovisual content spanning a duration of time, the method comprising the steps of:

identifying a candidate time within the duration of time spanned by the set of audiovisual content, the candidate time representing a possible starting and/or ending time of a commercial; and

evaluating the candidate time to determine a likelihood that the candidate time is a commercial starting time and/or ending time, wherein the evaluation is based at least in part on one or more characteristics of audiovisual content occurring after the candidate time.

48. (New) A method as in Claim 47, wherein the evaluation is further based, in part, on one or more characteristics of audiovisual content occurring before the candidate time.

49. (New) A method as in Claim 47, wherein the evaluation is based on one or more characteristics of audiovisual content occurring throughout the entire duration of time.

50. (New) A method for detecting a commercial in a set of audiovisual content spanning a duration of time, the method comprising the steps of:

identifying a candidate time within the duration of time spanned by the set of audiovisual content, the candidate time representing a possible starting and/or ending time of a commercial; and

evaluating the candidate time to determine a likelihood that the candidate time is a commercial starting time and/or ending time, wherein the evaluation is based at least in part on a relationship of the candidate time to one or more other candidate times.

51. (New) A method as in Claim 50, wherein the evaluation is based on a relationship of the candidate time to all other candidate times.

52. (New) A method for detecting a commercial in a set of audiovisual content spanning a duration of time, the method comprising the steps of:

evaluating the audiovisual content to identify the presence of a cue regarding the absence of a usually present network icon; and

identifying a candidate time within the duration of time spanned by the set of audiovisual content based on an evaluation of the identified cue, the candidate time representing a possible starting and/or ending time of a commercial.

53. (New) A method as in Claim 52, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding a sequence of black frames in the visual content, wherein a candidate time is identified based on an evaluation of one or more network icon and/or black frame cues.

54. (New) A method as in Claim 52, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding an audio pause in the audio content, wherein a candidate time is identified based on an evaluation of one or more network icon and/or audio pause cues.

55. (New) A method as in Claim 52, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding a scene cut or fade in the visual content, wherein a candidate time is identified based on an evaluation of one or more network icon and/or scene cut/fade cues.

56. (New) A method as in Claim 52, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding the occurrence of specified closed-captioning formatting signals and/or the absence of closed-captioning, wherein a candidate time is identified based on an evaluation of one or more network icon and/or closed-captioning cues.

57. (New) A method for detecting a commercial in a set of audiovisual content spanning a duration of time, the method comprising the steps of:

evaluating the audiovisual content to identify the presence of a cue regarding the presence of music in the audio content; and

identifying a candidate time within the duration of time spanned by the set of audiovisual content based on an evaluation of the identified cue, the candidate time representing a possible starting and/or ending time of a commercial.

58. (New) A method as in Claim 57, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding a sequence of black frames in the visual content, wherein a candidate time is identified based on an evaluation of one or more music and/or black frame cues.

59. (New) A method as in Claim 57, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding an audio pause in the audio content, wherein a candidate time is identified based on an evaluation of one or more music and/or audio pause cues.

60. (New) A method as in Claim 57, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding a scene cut or fade in the visual content, wherein a candidate time is identified based on an evaluation of one or more music and/or scene cut/fade cues.

61. (New) A method as in Claim 57, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding the occurrence of specified closed-captioning formatting signals and/or the absence of closed-captioning, wherein a candidate time is identified based on an evaluation of one or more music and/or closed-captioning cues.

62. (New) A method as in Claim 57, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding the absence of a usually present network icon, wherein a candidate time is identified based on an evaluation of one or more music and/or network icon cues.

63. (New) A method for detecting a commercial in a set of audiovisual content spanning a duration of time, the method comprising the steps of:

evaluating the audiovisual content to identify the presence of a cue regarding the density of scene cuts or fades in the visual content; and

identifying a candidate time within the duration of time spanned by the set of audiovisual content based on an evaluation of the identified cue, the candidate time representing a possible starting and/or ending time of a commercial.

64. (New) A method as in Claim 63, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding a sequence of black frames in the visual content, wherein a candidate time is identified based on an evaluation of one or more scene cut/fade density and/or black frame cues.

65. (New) A method as in Claim 63, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding an audio pause in the audio content, wherein a candidate time is identified based on an evaluation of one or more scene cut/fade density and/or audio pause cues.

66. (New) A method as in Claim 63, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding a scene cut or fade in the visual content, wherein a candidate time is identified based on an evaluation of one or more scene cut/fade density and/or scene cut/fade cues.

67. (New) A method as in Claim 63, further comprising the step of evaluating the audiovisual content to identify the presence of a cue regarding the occurrence of specified closed-captioning formatting signals and/or the absence of closed-captioning, wherein a candidate time is identified based on an evaluation of one or more scene cut/fade density and/or closed-captioning cues.

68. (New) A method for detecting a commercial in a set of audiovisual content spanning a duration of time, the method comprising the steps of:

evaluating the audiovisual content to identify the presence of a cue regarding speaker identity; and

identifying a candidate time within the duration of time spanned by the set of audiovisual content based on an evaluation of the identified cue, the candidate time representing a possible starting and/or ending time of a commercial.

In the abstract:

The abstract has been amended as follows:

The invention [identifies] enables identification of starting and ending times of commercial breaks, as well as starting and ending times of commercials within those commercial breaks, [can] to be found in audiovisual content (e.g., a television broadcast) using a method having characteristics which overcome disadvantages of previous commercial detection approaches. The invention is implemented as a solution to a "batch optimization" problem in which commercial locations within a set of audiovisual content are detected as a group by choosing a set of commercial locations which optimizes a cost function which can include consideration of, for example, 1) one or more of many types of visual recording, audio recording and/or closed-captioning cues, 2) relative locations of commercials within the audiovisual content, and/or 3) probability models based on statistics obtained regarding characteristics of typical commercial and commercial breaks (e.g., commercial and commercial break duration, separation times of commercials and commercial breaks, likelihood of the presence of a commercial at any given time in a set of audiovisual content). Optimization can be done

over the total set of commercial location decisions, rather than on a per-commercial basis. Additionally, the cost function can be iteratively evaluated, increasing the accuracy of commercial location decisions produced by the method. Additionally, many more types of cues and combinations of cues can be used in detection of commercials in accordance with the invention than have been used in other approaches to commercial detection.